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**Question Paper Code : 51445**

**B.E/B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016**

**Third Semester**

**Electronics and Communication Engineering**

**EC 2204/EC 35/EC 1202 A/10144 EC 305/080290015 – SIGNALS AND SYSTEMS**

**(Common to Biomedical Engineering)**

**(Regulations 2008/2010)**

**Time : Three Hours**

**Maximum : 100 Marks**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. Check whether the discrete time signal  $\sin 3n$  is periodic.
2. Define a random signal.
3. What is the relationship between Fourier transform and Laplace transform ?
4. State Dirichlet's conditions.
5. Determine the Laplace transform of the signal  $\delta(t - 5)$  and  $u(t - 5)$ .
6. Determine the convolution of the signals  $x[n] = \{2, -1, 3, 2\}$  and  $h[n] = \{1, -1, 1, 1\}$ .
7. What is aliasing ?
8. Define unilateral and bilateral Z transform.
9. Convolve the following two sequences :

$$x(n) = \{1, 1, 1, 1\}$$

$$h(n) = \{3, 2\}$$

10. A causal LTI system has impulse response  $h(n)$ , for which the z-transform is

$$H(z) = \frac{1 + z^{-1}}{(1 - 0.5z^{-1})(1 + 0.25z^{-1})}. \text{ Is the system stable? Explain.}$$

**PART - B (5 × 16 = 80 Marks)**

11. (a) Determine whether the systems described by the following input-output equations are linear, dynamic, casual and time variant. (16)

(i)  $y_1(t) = x(t - 3) + (3 - t)$

(ii)  $y_2(t) = dx(t)/dt$

(iii)  $y_1[n] = n x[n] + bx^2[n]$

(iv) Even  $\{x[n - 1]\}$

**OR**

- (b) A Discrete time system is given as  $y(n) = y^2(n - 1) = x(n)$ . A bounded input of  $x(n) = 2\delta(n)$  is applied to the system. Assume that the system is initially relaxed. Check whether system is stable or unstable. (16)

12. (a) (i) Compute the Laplace transform of  $x(t) = e^{-b|t|}$  for the cases of  $b < 0$  and  $b > 0$ . (10)

- (ii) State and prove Parseval's theorem of Fourier transform. (6)

**OR**

- (b) (i) Determine the Fourier series representation of the half wave rectifier output shown in figure below. (8)



- (ii) Write the properties of ROC of laplace transform. (8)

13. (a) (i) Define convolution integral and derive its equation. (8)
- (ii) A stable LTI system is characterized by the differential equation

$$\frac{d^2 y(t)}{dt^2} + 4 \frac{dy(t)}{dt} + 3y(t) = \frac{dx(t)}{dt} + 2x(t)$$

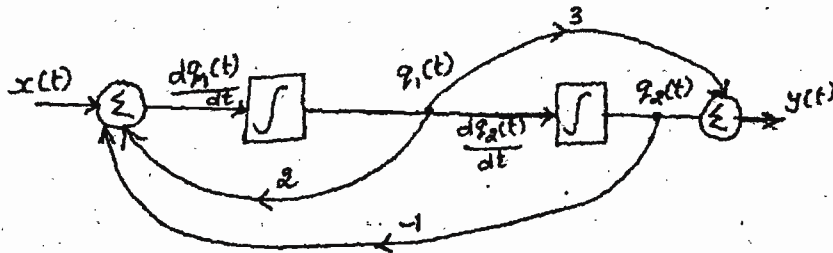
Find the frequency response and impulse response using Fourier transform. (8)

OR

- (b) (i) Draw direct form, cascade form and parallel form of a system with system function.

$$H(s) = \frac{1}{(s+1)(s+2)} \quad (8)$$

- (ii) Determine the state variable description corresponding to the block diagram given below. (8)



14. (a) (i) State and prove sampling theorem. (8)
- (ii) Using Z-transform, find the convolution of two sequences  $x_1(n) = \{1, 2, -1, 0, 3\}$  and  $x_2(n) = \{1, 2, -1\}$ . (4)
- (iii) Find the  $X(Z)$  if  $x(n) = n^2 u(n)$ . (4)

OR

- (b) (i) Find inverse Z transform of  $X(Z) = \frac{Z(Z-1)}{(Z+2)^3(Z+1)}$  Roc:  $|Z| > 2$ . (8)
- (ii) The Nyquist rate of a signal  $x(t)$  is  $\Omega_0$ . What is the nyquist rate of the following signals? (8)
- (1)  $x(t) - x(t-1)$ .
- (2)  $x(t) \cos \Omega_0 t$ .

15. (a) (i) Find the system function and the impulse response  $h(n)$  for a system described by the following input-output relationship.

$$y(n) = \frac{1}{3} y(n-1) + 3x(n). \quad (6)$$

- (ii) A linear time-invariant system is characterized by the system function

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}.$$

Specify the ROC of  $H(z)$  and determine  $h(n)$  for the following conditions :

- (1) The system is stable
- (2) The system is causal
- (3) The system is anti-causal. (10)

**OR**

- (b) (i) Derive the necessary and sufficient condition for BIBO stability of an LSI system. (6)
- (ii) Draw the direct form, cascade form and parallel form block diagrams of the following system function : (10)

$$H(z) = \frac{1}{\left(1 + \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}.$$

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